generally known in the art, including for example, compounds comprising fused aromatic rings or Teflon® polytetrafluoroethylene and like oligomers, such as -(CF_2)_. -(CHF)_ and -(CFR)_. See for example, Schumm et al., Angew. Chem. Intl. Ed. Engl. 33:1361 (1994); Grosshenny et al., Platinum Metals Rev. 40(1):26-35 (1996); Tour, Chem. Rev. 96:537-553 (1996); Hsung et al., Organometallics 14:4808-4815 (1995); and references cited therein, all of which are expressly incorporated by reference.)--

REMARKS

Preliminary Matters

1. Applicants thankfully acknowledge that our request for a Continued Prosecution Application (CPA) has been accepted.

2. Claims 20, 22-30 are pending in the instant application. No new matter is introduced by the amendments.

Drawings

3. Applicants acknowledge the Examiner's reminder regarding the requirement for the submission of formal drawings. Applicants are in the process of preparing formal drawings and will submit them under separate cover once they are ready.

Information Disclosure Statement

4. The Examiner asserted that the listing of references in the specification is not a proper information disclosure statement. In fact, the listing of references in the specification is not intended by applicants to be an information disclosure statement, rather

the listing merely expands and enhances the teaching of the specification. A proper information disclosure statement and proper subsequent supplemental information disclosure statements have been filed in connection with the instant application. Thus, Applicants respectfully request withdrawal of the rejection relating to the listing of these references in the specification.

Specification

5. The specification has been checked for minor errors and corrected where necessary. Accordingly, Applicants respectfully request that the rejection be withdrawn.

6. Trademarks in the amended specification have been capitalized wherever they appear and are accompanied by the appropriate generic terminology. Accordingly, withdrawal of the rejection is requested.

7. The Examiner stated that the drawings on pages 14-20 and 22-33 are improper and should be submitted to the office as required by 37 C.F.R.§ 1.81.

Applicants have amended the specification and removed the drawings on pages 14-20. The drawings shown on pages 14-20 have been incorporated in Figures 7A-7T. Applicants respectfully request withdrawal of the rejection of the drawings on pages 14-20.

With regard to the drawings on pages 22-23, Applicants respectfully submit that these drawings depict the chemical structures of conductive oligomers. Applicants respectfully draw the Examiner's attention to 376 C.F.R. §1.58(a), which states, "[t]he

specification, including the claims, may contain chemical and mathematical formulas...". Applicants further point to United States Patent No. 6,013,170 (Exhibit A in our previous response to Office Action) and exemplary pages from allowed Application Serial No. 08/911,589 (Exhibit B in our previous response to Office Action) which contain chemical formulas similar to those found in the present application. Accordingly, Applicants request withdrawal of the rejection relating to the drawings on pages 22-23.

Claim rejections - 35 U.S.C. §103

10. Claims 18, 20, 22, 23, and 25-30 are provisionally rejected under 35 U.S.C. §103 as being obvious over copending Application No. 08/873,597, which has a common inventor with the instant application.

Applicants acknowledge that the terminal disclaimer filed on April 3, 2001 cannot be used to obviate a rejection based on 35 U.S.C. §103(a) prior art. However, as the Examiner has pointed out on page 7 of her Office Action, "[f]or applications filed on or after November 29, 1999, this rejection might be overcome by showing that the subject matter of the reference and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person." See also 35 U.S.C. §103(c). The mere filing of a continuing application on or after November 29, 1999 will serve to exclude commonly owned 35 U.S.C. §102(e) prior art that was applied, or could have been applied, in a rejection under 35 U.S.C. §103 in the parent application. M.P.E.P. 706.02(l)(1).

The 08/873,597 application was filed on June 12, 1997. The present application was filed on June 12, 1998. The CPA request for the present application was filed on April

3, 2001, which is after the date of November 29, 1999. Therefore, as the Examiner has suggested under 35 U.S.C. §103(c), the 08/873,597 application cannot be used as a prior art against the present application if the subject matter of the 08/873,597 application and the claimed invention were, at the time the invention was made, owned by the same person or subjected to an obligation of assignment to the same person as was the present invention.

As have been previously submitted, the 08/873,597 application and the present application are assigned to the same entity, namely, Clinical Micro Sensors, Inc. (recently purchased by Motorola). Copies of the assignments of the two applications which indicate that Clinical Micro Sensors, Inc. was the assignee have been submitted in our previous response to the Office Action. Furthermore, Applicants respectfully direct the Examiner to reel/frame 9555/0326 which documents the assignment of the present case, and reel/frame 8875/0764 which documents the assignment of application No. 08/873,597. Since both the present application and the 08/873,597 application were subject to an obligation of assignment to the same person at the time the present invention was made, Applicant submit that the 08/873,597 application is not a proper reference upon which to base a rejection under 103(a). Accordingly, Applicants respectfully request the Examiner to withdraw the rejection as to the 08/873,597 application.

In addition, Applicants are preparing new assignments from Clinical Micro Sensors to Motorola, Inc. which will be submitted under separate cover.

11. (I) Claims 18, 20, and 25-30 are rejected under 35 U.S.C. §103(a) as being unpatentable over Keen (U.S. Patent No. 6,060,327) in view of Kossovsky et al. (US

Patent No. 5,585,646) and in further view of Wohlstadter et al. (US Patent No. 6,090,545).

As discussed in our previous responses to the Office Actions, the present invention is directed to the detection of target analytes using a biosensor. Detection in this system is based on the fact that at least one redox property of a redox active molecule is altered as a result of its association with a target analyte. The change in the redox property of the redox active molecule as a result of association with an analyte alters the faradaic impedance of the system. This alteration in the faradaic impedance of the system results in a detectable signal. Thus, the present invention provides a biosensor for the detection of target analytes, and comprises electrodes, self-assembled monolayers, and binding ligands covalently attached to the electrodes via spacers, including, for example, conductive oligomers.

Keen is directed to a sensor comprising: (a) a plurality of conductive polymer strands, each having a first and second end, aligned in a common orientation; (b) a plurality of head groups that are attached to the first end of the conductive polymer strand, each head group capable of an enzymatic reaction resulting in the generation of electrons; and (c) an electrode substrate attached to the second end of the conductive polymer strands.

As the Examiner acknowledges, Keen does not teach or suggest either a self-assembled monolayer or an array of electrodes. Furthermore, the head groups disclosed in Keen are deposited onto the conductive polymers on the electrodes, rather than covalently attached to the electrodes (see, e.g., col. 17 and col. 22 in Keen).

Kossovsky et al. describe bioelectronic devices in which a layer of electronically active biochemical material is bound to the surface of a semiconductor substrate via a

stabilization layer comprising an oligomer. The oligomer layer functions as a biochemical stabilization layer to prevent denaturation of the electronically active biochemical molecule.

Kossovsky et al. neither teach nor suggest using these bioelectronic devices for the detection of target analytes in biological samples. In addition, Kossovsky et al. do not teach or suggest a binding ligand that is covalently attached to an electrode. Furthermore, there is no discussion in Kossovsky et al. about electrode arrays.

Wohlstadter et al. disclose materials and methods for producing patterned multi-array, multi-specific surfaces ("PMAMS"), which can be electronically excited for electrochemiluminescence based tests. The PMAMS comprises a plurality of binding domains deposited on a surface that is normally separate from and spatially aligned with one or more electrodes. When an appropriate potential is applied to the electrodes, electrochemiluminescent labels will be stimulated to create light, which can then be detected.

Unlike the present invention, the binding domains in Wohlstadter et al. are not attached to the electrodes. More importantly, they do not need to make mechanical contact with the electrodes to stimulate electrochemiluminescence (see col. 10 of Wohlstadter et al.). Furthermore, the target analytes are detected based on electrochemiluminescence, rather than electronic or electrochemical detection.

To establish a *prima facie* case of obviousness, three criteria must be met: i) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teaching; ii) the prior art reference (or references when combined)

must teach or suggest all the claim limitations; and iii) there must be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); M.P.E.P. §2143.

As a preliminary matter, Applicants reassert their arguments that Kossovsky et al. is not analogous art as modifying the surface of semiconductors is not in the field of applicant's endeavor, nor reasonably pertinent to the development of biosensors capable of detecting biological substances. (See *In re Oetiker*, 977 F.2d 1443, 1446, 24 U.S.P.Q.2d 1443, 1445 (Fed. Cir. 1992); M.P.E.P. §2141.01(a); "In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned."). In support of this position of non-analogous art, the Applicants draw the Examiner's attention to M.P.E.P. § 2141.01(a), which outlines the guidelines regarding analogous art. The present invention has been placed in class 422, Chemical Apparatus and Method, while Kossovsky et al. is in class 257, "Active Solid State Devices" (e.g. Transistors and Solid-State Diodes).

Even assuming, *arguendo*, that Kossovsky et al. is analogous art, a *prima facie* case of obviousness still cannot be established.

First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teaching.

Th Examiner asserts that because self-assembled monolayers (SAMs) are well

known in the art, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the SAMs taught by Kossovsky et al. in the method of Keen for the detection of analytes. As the Examiner is aware, the fact that the references relied upon teach all aspects of the claimed invention individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *Ex Parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). See also M.P.E.P. §2143.01. Thus, although SAMs are well known in the art, it does not necessarily follow that it will be obvious to one of ordinary skill in the art to use SAMs in the method of Keen without a specific teaching to do so. None of the references cited by the Examiner, either alone or in combination, has provided a reason or motivation to include a SAM in the sensor taught by Keen.

Similarly, the mere fact that the multi-electrode arrays as taught by Wohlstadter et al. are well known in the art does not make it obvious to use the multi-electrode arrays of Wohlstadter et al. in the method of Keen. As the Examiner acknowledges, Wohlstadter et al. focuses on the use of multi-electrode arrays for electrochemiluminescence assays. It neither teaches nor suggests the use of multi-electrode arrays to detect target analytes based on electronic or electrochemical detection. On the other hand, neither Keen nor Kossovsky et al. teach or suggest an array of electrodes. Without a specific teaching, it would not have been obvious to an ordinarily skilled artisan to use a multi-electrode array to detect target analytes based on electronic detection.

Furthermore, as discussed above, none of the references have disclosed a binding ligand that is covalently attached to the electrode. Thus the requirement that the prior art references teach or suggest all the claim limitations is not met.

Finally, an ordinarily skilled artisan would not have a reasonable expectation of success in arriving at the instant invention because it is not obvious that by combining the sensor of Keen (as described above) with the semiconductor device taught by Kossovsky et al. and the method of electrochemiluminescence detection taught by Wohlstadter, a "sensor" as taught in the present invention would be functional. That is, a person of reasonable skill in the art would not expect to make a biosensor for the electronic detection of biological materials (i.e., target analytes) using a combination of electrodes, SAMs, and binding ligands based on the combined teaching of Keen, Kossovsky, and Wohlstadter.

For the above reasons, Applicants respectfully assert that Keen, Kossovsky et al., and Wohlstadter et al., either alone or in combination, do not make the present application obvious. Applicants respectfully request the rejection be withdrawn.

II. Claims 22 and 23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Keen (U.S. Patent No. 6,060,327) in view of Kossovsky et al. (U.S. Patent No. 5,585,646) and in further view of Wohlstadter et al. (U.S. Patent No. 6,090,545) and further in view of Meade (U.S. Patent No. 6,013,459).

As discussed above, due to the present filing of a continuing application under 37 C.F.R. 1.53(d), the present application is subject to the new rules for applications filed subsequent to November 29, 1999. For instance, the revised 35 U.S.C. §103(c) provides that "[s]ubject matter developed by another person, which qualifies as prior art only under one or more subsections (e), (f), and (g) of section 102...shall not preclude patentability under this section where the subject matter and the claimed invention were...subject to an obligation of assignment to the same person."

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As we have previously submitted, Meade and the present application are assigned to the same entity, namely, Clinical Micro Sensors, Inc. Applicants respectfully draw the Examiner's attention to copies of the assignments of the two applications which indicate that Clinical Micro Sensors, Inc. is the assignee, attached to our previous response as Exhibits C and D. Applicants draw the Examiner's attention to reel/frame 9555/0167 (Exhibit C) which documents the assignment of the Meade reference. Furthermore, Applicants respectfully direct the Examiner to reel/frame 9555/0326 (Exhibit D) which documents the assignment of the present case. Thus under 35 U.S.C. 103(c), Meade is not a prior art against the present application. Accordingly, Applicants respectfully request the rejection be withdrawn.

Applicants respectfully submit that the claims are now in condition for allowance and early notification to that effect is respectfully requested. If after review, the Examiner feels there are further unresolved issues, the Examiner is invited to call the undersigned at (415) 781-1989.

The Commissioner is authorized to charge any additional fees, including any extension fees, which may be required, or credit any overpayment to Deposit Account No. 06-1300 (Our Order No. A-64559-3/RFT/RMS/RMK).

Dated: 11/19/01

Respectfully submitted,

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By: _____
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Robin Silva, Reg. No. 38, 304

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Paragraph beginning at page 2, line 15 has been amended as follows:

--Accordingly, in accordance with the above objects, the present invention provides methods of detecting a target analyte in a test sample comprising a redox active molecule and an analyte. The method comprises applying an input signal to the test sample and detecting a change in the faradaic impedance of the system as a result of the association of the redox active molecule with the analyte.--

Paragraph beginning at page 2, line 25 has been amended as follows:

--The methods further [comprising] comprise applying a first input signal to said redox active complex; the input signal can comprise an AC component and/or a DC component.--

The following paragraph has been inserted between line 7 and line 8 on page 4 of the specification:

--Figures 7A-T depict the configurations of a number of specific systems according to the invention. Figure 7A depicts a system used to detect pollutants. Figures 7B-E depict systems used to detect target analytes that bind to a binding ligand specifically. Figure 7F depicts a system in which binding of a target analyte theoretically affects the H_{AB} between the RAM and the electrode. Figure 7G depicts a system similar to Figure 7F, except that the binding ligand is inherent in the attachment of the RAM to the electrode. Figure 7H depicts a situation in which the analyte also serves as the redox active

molecule. Figure 7I depicts a competitive-type assay which relies on a decrease in signal for detection. Figure 7J depicts a competitive-type assay which results in a change in signal, rather than a decrease in signal. Figure 7K depicts a system that utilizes a change in the diffusion coefficient upon analyte binding for the change in faradaic impedance and mass transfer. Figure 7L depicts a system that relies on a change in ligands to result in a change in E_0 of the system. Figure 7M is a variation of the previous system, and depicts a situation in which the RAM and the BL are closely associated or linked. Figure 7N depicts a system that results in changes in faradaic impedance as a result of changing E_0 or H_{AB}. Figure 7O depicts a system that uses two binding ligands, BL_1 and BL_2, which may be the same or different, to alter the environment of the RAM. Figure 7P depicts a system in which a target analyte is used that will bind the metal ion-binding ligand complex in such a way as to render the metal unavailable to serve as a redox active molecule. Figure 7Q depicts a system that utilizes a change in metal ion affinity to a particular binding ligand to detect a change in the signal based on a different metal being present (resulting in a different E_0). Figure 7R is a variation of the system shown in Figure 7I, and depicts a competitive-type assay for detecting a target analyte. Figure 7S is a mixture of Figure 7B and 7R, and depicts a system where the replacement of a bulky analog by a smaller target analyte results in a different signal. Figure 7T depicts a two electrode system in a competitive-type assay.--

Paragraph beginning at page 14, line 1 has been amended as follows:

--In a preferred embodiment, the system is used to detect pollutants, such as organic pollutants, as is depicted in System 1, Figure 7A.--

The drawing at page 14, lines 3-8 has been deleted.

Paragraph beginning at page 14, line 24 has been amended as follows:

--Systems 2, 3, 4, and 5 (see Figures 7B-7E, respectively) depict a similar situation except that a specific interaction is exploited. Thus, the target analyte will bind to the binding ligand specifically, and is generally large as compared to the binding ligand and RAM. Upon binding, the local environment of the RAM is affected, for example potentially by changing the E_0 of the RAM or the solvent reorganization energy, and thus results in a change in the faradaic impedance of the system in the presence of the analyte. The target analyte in these cases could be protein, a cell, etc. In addition, any or all of these systems may be used with co-redoxants, as described below. Upon binding of the target analyte, the access of the co-redoxant to the RAM is restricted, thus resulting in either a different signal or a loss in signal, or both. In addition, as for all the systems depicted herein, the order or proximity of the individual molecules of the monolayer is not determinative.--

The drawing at page 14, lines 34-39 has been deleted.

The drawings at page 15, lines 7-24 have been deleted.

Paragraph beginning at page 15, line 25 has been amended as follows:

--System 6 (see Figure 7F) depicts a system in which binding of a target analyte theoretically affects the HAB between the RAM and the electrode:--

The drawing at page 15, lines 27-33 has been deleted.

Paragraph beginning at page 15, line 34 has been amended as follows:

--System 7 (see Figure 7G) depicts a similar situation, except that the binding ligand is inherent in the attachment of the RAM to the electrode; for example, it may be a peptide or nucleic acid to which the analyte binds.--

Line 36 on page 15 has been deleted.

The drawing at page 16, lines 1-5 has been deleted.

Paragraph beginning at page 16, line 6 has been amended as follows:

--System 8 (see Figure 7H) depicts a situation in which the analyte also serves as the redox active molecule; this is particularly useful in the detection of metal ions, for example heavy metal ions, which are toxic. System 8 depicts a metal ion, M, and a metal ligand, ML, although as will be appreciated by those in the art, it is quite possible to have the analyte in this case be a metalloprotein, with a BL, etc. As will be appreciated by those in the art, System 8 is particularly useful in the detection of different metal ions, using an array of different ligands; preferential binding of one metal over another would result in a panel of results that can be correlated to metal ligand binding. Moreover, different metals may have different E_0s and thus give different signals.--

The drawing at page 16, lines 14-19 has been deleted.

Paragraph beginning at page 16, line 20 has been amended as follows:

--System 9 (see Figure 7I) depicts a competitive-type assay which relies on a decrease in signal for detection. In this case, the target analyte is a ligand, for example carbon monoxide (CO), which are stronger ligands (SMLs, i.e. have higher binding constants) for a particular metal than the weaker metal ligand (WML) of the system.--

The drawing at page 16, lines 24-29 has been deleted.

Paragraph beginning at page 16, line 30 has been amended as follows:

--System 10 (see Figure7J) depicts a similar type of assay, which results in a change in signal rather than a decrease in signal. For example, E_0 and λ could both change as a result of a new ligand binding.--

The drawing at page 16, lines 32-39 has been deleted.

Paragraph beginning at page 17, line 1 has been amended as follows:

--System 11 (see Figure 7K) utilizes a change in the diffusion coefficient upon analyte binding for the change in faradaic impedance and mass transfer. In this embodiment, when the ligands are not covalently attached to an electrode, changes in the diffusion coefficient will alter the mass transfer impedance and thus the total faradaic impedance. That is, in some circumstances the frequency response of a redox active complex will be limited by its diffusion coefficient. Also, the charge transfer impedance may be altered by the binding of an analyte. At high frequencies, a redox active complex may not diffuse rapidly enough to reversibly transfer its electron to the electrode at a rate sufficient to generate a strong output signal. At low frequencies, the molecule has sufficient time to diffuse, and thus an output signal can be detected. In this embodiment, the use of monolayers is generally not preferred.--

The drawing at page 17, lines 22-27 has been delcted.

Paragraph at page 17, lines 28 has been amended as follows:

--System 12 (see Figure 7L) is similar to systems 10 and 11, as it is a sensor for different ligands, but it relies on a change in ligands to result in a change in E_0 of the system. A similar system may be used with two metals; that is, instead of adding strong metal ligands, a different metal, with different affinity for the ligands may be added, resulting in a electrochemical change.--

The drawing at page 18, lines 1-6 has been deleted.

Paragraph beginning at page 18, line 7 has been amended as follows:

--System 13 (see Figure 7M) is a variation on previous systems, except that the

RAM and the BL are closely associated or linked.--

The drawing at page 18, lines 9-14 has been deleted.

Paragraph beginning at page 18, line 15 has been amended as follows:

--System 14 (see Figure 7N) results in changes in faradaic impedance as a result of changes in E_0 or H_{AB}. In this case, the binding ligand will self-associate in some way, bringing the RAM into closer proximity to the electrode. For example, the binding ligand may be a nucleic acid (for example for the detection of a nucleic acid binding protein) or a protein (for example for the detection of proteins that inhibit or bind the binding ligand protein. Upon binding of the target, for example a protein, the conformation and thus the local environment of the RAM changes, resulting in a detectable signal. System 14 [15] could also be run in "reverse", wherein the association of the analyte brings the RAM into proximity of the surface.--

The drawing at page 18, lines 23-28 has been deleted.

Paragraph beginning at page 18, line 29 has been amended as follows:

--System 15 (see Figure 7O) uses two binding ligands, BL1 and BL2, which may be the same or different, to alter the environment of the RAM. It may be desirable to have one of the binding ligands be a somewhat "generic" binding ligand. Changes in E_0 and/or impedance will result in a detectable signal.--

The drawing at page 18, lines 32-39 has been deleted.

Paragraph beginning at page 19, line 1 has been amended as follows:

--System 16 (see Figure 7P) also relies on a decrease in signal. In this embodiment, a target analyte is used that will bind the metal ion-binding ligand complex in such a way as to render the metal unavailable to serve as a redox active molecule.--

The drawing at page 19, lines 4-8 has been delcted.

Paragraph beginning at page 19, line 9 has been amended as follows:

--System 17 (see Figure 7Q) utilizes a change in metal ion affinity to a particular binding ligand to detect a change in the signal based on a different metal being present (resulting in a different E_0).--

The drawing at page 19, lines 11-16 has been deleted.

Paragraph beginning at page 19, line 17 has been amended as follows:

--System 18 (see Figure 7R) is similar to System 9 and depicts a competitive-type assay for detecting a target analyte. In System 18 [15], a covalently attached target analyte or target analog (TA) is competed off the binding ligand by the addition of the target analyte, resulting in a decrease in signal.--

The drawing at page 19, lines 20-25 has been deleted.

Paragraph beginning at page 19, line 26 has been amended as follows:

--System 19 (see Figure 7S) is a mixture of Systems 2 and 18, where the replacement of a bulky analog (TA) by a smaller target analyte (T) results in a different signal. For example, co-redoxant reactions could now occur. Alternatively, monolayers with "holes", that would allow current flow in the absence of the analog but do not in its presence, could also be used.--

The drawing at page 19, lines 30-35 has been deleted.

Paragraph at page 20, line 1 has been amended as follows:

--System 20 (see Figure 7T) depicts a two electrode system in a competitive-type assay. This is useful in that it allows detection of an increase in signal on the second electrode, which is generally preferable to the loss of a signal.--

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The drawing at page 20, lines 4-15 has been deleted.

Paragraph beginning at page 26, line 26 has been amended as follows:

--As will be appreciated by those in the art, a large number of possible conductive oligomers may be utilized. These include conductive oligomers falling within the Structure 1 and Structure 8 formulas, as well as other conductive oligomers, as are generally known in the art, including for example, compounds comprising fused aromatic rings or Teflon® polytetrafluoroethylene and like oligomers, such as -$(CF_2)_-$, -(CHF)_ and -(CFR)_. See for example, Schumm et al., Angew. [angew] Chem. Intl. Ed. Engl. 33:1361 (1994);Grosshenny et al., Platinum Metals Rev. 40(1):26-35 (1996); Tour, Chem. Rev. 96:537-553 (1996); Hsung et al., Organometallics 14:4808-4815 (1995; and references cited therein, all of which are expressly incorporated by reference.)--

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Appendix of Pending Claims

20. (Twice Amended) An apparatus for the detection of a non-nucleic acid target analyte in a test sample, comprising:

a) a test chamber comprising an array of electrodes each comprising:

i) a self-assembled monolayer; and

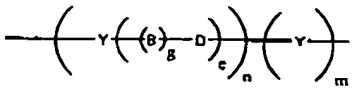
ii) a binding ligand covalently attached to said electrode via a [spacer]conductive oligomer;

wherein said test chamber further comprises at least one second measuring electrode; and

b) a voltage source electrically connected to said test chamber; and

c) an electronic detector.

22. (Amended) An apparatus according to claim 20 wherein said conductive oligomer has the formula:



wherein

Y is an aromatic group;

n is an integer from 1 to 50;

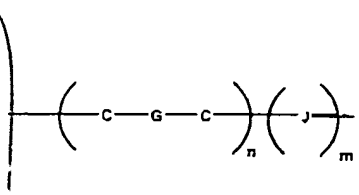
g is either 1 or zero;

e is an integer from zero to 10; and

m is zero or 1;

wherein when g is 1, B-D is selected from acetylene, alkene, substituted alkene, amide, azo, esters, thioesters, -CH=N-, -CR=N-, -N=CH- and -N=CR-, -SiH=SiH-, -SiR=SiH-, -SiR=SiH-, and -SiR=SiR-, -SiH=CH-, -SiR=CH-, -SiH=CR-, -SiR=CR-, -CH=SiH-, -CR=SiH-, -CH=SiR-, and -CR=SiR-; and wherein when g is zero, e is 1 and D is [preferably] carbonyl, or a heteroatom moiety, wherein the heteroatom is selected from oxygen, sulfur, nitrogen, silicon or phosphorus/

23. An apparatus according to claim 20 wherein said conductive oligomer has the formula:



wherein

n is an integer from 1 to 50;

m is 0 or 1;

C is carbon;

J is carbonyl or a heteroatom moiety, wherein the heteroatom is selected from the group consisting of oxygen, nitrogen, silicon, phosphorus, sulfur; and

G is a bond selected from alkane, alkene or acetylene, wherein if m = 0, at least one G is not alkane.

24. Cancelled.

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25. (Twice Amended) An apparatus according to claim 20 or 30 wherein said self-assembled monolayer comprises insulators.

26. (Twice Amended) An apparatus according to claim 20 or 30 wherein said self-assembled monolayer comprises conductive oligomers.

27. (Twice Amended) An apparatus according to claim 20 or 30 wherein said self-assembled monolayer comprises insulators and conductive oligomers.

28. (Twice Amended) An apparatus according to claim 20 or 30 wherein said binding ligand is a protein.

29. (Amended) An apparatus according to claim 20 or 30 further comprising a processor coupled to said electrodes and configured to receive an output signal.

30. (New) An apparatus for the detection of a non-nucleic acid target analyte in a test sample, comprising:

a) a test chamber comprising an array of electrodes each comprising:

i) a self-assembled monolayer; and

ii) a binding ligand covalently attached to said electrode via an insulator; wherein said test chamber further comprises at least one second measuring electrode; and

b) a voltage source electrically connected to said test chamber; and

c) an electronic detector.